



SYSTEMATICS OF THE *SEDUM PARVUM* GROUP (CRASSULACEAE) IN
NORTHEASTERN MEXICO AND TEXAS

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ABSTRACT

In a systematic study of the yellow-flowered species of *Sedum* of northeastern México and Texas, those traditionally interpreted as the *S. parvum* Hemsl. group, we elevate or reinstate to species rank three taxa regarded by Clausen as subspecies of *S. parvum*: *S. catorce* stat. et nom. nov. (= *S. parvum* subsp. *dendroides* R.T. Clausen), *S. nanifolium* Frod. (*S. parvum* subsp. *nanifolium* [Frod.] R.T. Clausen), and *S. diminutum* stat. et comb. nov. (= *S. parvum* subsp. *diminutum* R.T. Clausen). In addition, three new species are proposed: *S. dulcinomen* Nesom, *S. papillicaulum* Nesom, and *S. macdonaldii* Nesom.

KEY WORDS: Crassulaceae, *Sedum*, México, systematics

This study was begun as a consequence of the observation by McDonald (1991) that two separate species of *Sedum* occur on the tops of the high peaks of southeastern Coahuila. Robert Clausen had earlier identified and annotated nearly all of the yellow-flowered species of *Sedum* in the Sierra Madre of Coahuila and Nuevo León as *S. parvum* Hemsl. subsp. *nanifolium* (Frod.) R.T. Clausen, although many of the collections cited in the present study have been made since his death. With further study, it became apparent that only one of these high elevation taxa could be identified as subsp. *nanifolium*. Several other entities related to *S. parvum*, at high and lower elevations in the Sierra Madre and adjacent areas, represent undescribed species. Further, based on a more restricted species concept than Clausen's, we believe that a group of taxa described by him as subspecies of *S. parvum* are better treated at specific rank. Clausen espoused, theoretically and practically, a very broad species concept (1984, p. 9): "The concept of species is best reserved for a level of differentiation that is major, involves many genetic characters, and is especially distinguished by impressive biological discontinuity where two or more species occur together." The

subspecies of this group, however, are allopatric non-intergrading taxa of northeastern México and the morphological distinctions among them are equivalent to those of accepted species in many genera of various other families.

Distinctive features of the *Sedum parvum* group are yellow, erect petals, yellow anthers and ovaries, and relatively small, elongate leaves drying with a flat to slightly concave adaxial surface (see below). Two other Mexican species clearly are members of the same group, *Sedum reptans* R.T. Clausen of San Luis Potosí and Querétaro, and *S. tamaulipense* Nesom of Tamaulipas. These taxa are distinctive in their spreading petals and fully terete leaves, but in their completely prostrate habit they are perhaps closely related to *S. parvum*. *Sedum nuttallianum* Raf., an erect annual common in Texas and the south-central United States, also appears to be very closely related (Nesom 1988). Clausen (1975) included the latter as the most divergent member of subgenus *Sedum* sect. *Lanceolata*, in which he otherwise included only species from north of México, but he noted that it is related to *S. parvum* "on the basis of morphology and geography." Finally, *S. greggii* Hemsl. and *S. grandipetalum* Frod. of the Trans-Mexican Volcanic Range, and perhaps *S. humifusum* Rose and *S. cupressoides* Hemsl., also appear to belong with this assemblage of taxa. According to Praeger (1921), these would be members of sect. "Seda Genuina Koch" (= sect. *Sedum*).

Other yellow-flowered species of *Sedum* in México may constitute more than one natural group apart from the *S. parvum* group. All, however, have flat (fresh) leaves, mostly 6-20 mm wide (much wider than the taxa treated in the present paper) and 15-40 mm long, and the inflorescences tend to be elevated well above the normally developed cauline leaves. Only one of them, *S. palmeri*, occurs in northeastern México.

Variation in leaf shape and arrangement

Clausen (1978) referred to *Sedum greggii* and *S. grandipetalum* as "heterophyllous," in reference to the "leaves of the elongate floriferous stems [which] are markedly different from those of the vegetative shoots or compact rosettes." Species treated in the present study also present a type of heterophylly, although it may not be homologous with that of those noted above. These produce short, vegetative, lateral branches with spreading, imbricately arranged leaves so densely packed that the stem surface is not evident. Sometimes, however, the floriferous branches of these also produce densely packed leaves resembling those of the lateral branches. In any case, five essentially prostrate species covered in this study (in the key below) do not produce this type of leaf arrangement vegetatively or otherwise but rather the leaves are evenly and well-spaced, leaving the stem surface in view. Such species without a marked dimorphism in leaf morphology Clausen called "homophyllous."

In Clausen's key to the species of the Mexican Cordilleran Plateau (1984), an early couplet distinguished "leaves flat, 2 or more times broader than thick" (*Sedum greggii*) from "leaves terete, subterete, or at least not 2 or 3 times broader than thick" (*S. parvum* and *S. reptans*). These choices were in reference to living material, which Clausen expected users of his key to have on hand (or else field notes describing the original morphology), but the leaves of *Sedum* shrink radically upon drying and it

becomes difficult to surmise the original shape. The relative position of the midvein in dried leaves does provide a clue to the original shape. The key below presents choices based on dried material, and notes on the morphology of fresh material are provided in the species descriptions where this information is available. The leaves of the *S. parvum* group have a strong tendency to markedly flatten when dried, even to the point of displaying two, sharply acute, lateral margins. The leaves of *S. nanifolium* Frod. and *S. macdonaldii* Nesom usually dry with a relatively flat adaxial surface and convex abaxial one with rounded, poorly defined margins. These are referred to as "half-terete" in the descriptions below. Although the leaf shape (in cross-section) is constant within a species, it does not appear to be of critical importance in indicating phylogenetic relationships, if our supposition is correct that *S. nanifolium* is most closely related to *S. chrysauculum* J.A. McDonald, which has markedly flattened leaves with strongly differentiated margins.

Variation in stem and leaf surface texture

Three basic types of stem morphology in the *Sedum parvum* group can be identified: 1) smooth, non-shiny, without visible cellular structure; 2) smooth, shiny, with elongated cells evident; and 3) papillate, non-shiny, with quadrate cells evident. The following groups of species correspond to the three stem types: 1) *S. reptans*, *S. nuttallianum*, *S. tamaulipense*; 2) *S. parvum*, *S. diminutum* (R.T. Clausen) Nesom, *S. nanifolium*, *S. chrysauculum*; and 3) *S. papillicaulum* Nesom, *S. macdonaldii*, *S. catorce* Nesom, *S. dulcinomen* Nesom. These three morphologies are so distinctly different that we believe that the three species groups may represent separate phyletic lineages, each including species both of erect and prostrate habit. It is surprising that Clausen did not recognize the usefulness of this character among the species treated in the present study, because he used the same character in several key couplets (Clausen 1984) to delimit groups of species unrelated to the *S. parvum* group.

Description of the *Sedum parvum* group

Unless otherwise noted, the descriptions and measurements below are taken from dried, pressed specimens. Elaboration is found in the paragraphs above.

Erect or prostrate-decumbent perennials, annual in one species, somewhat woody in the lower portions, completely herbaceous in one species. Stems glabrous, smooth or papillate. Homophyllous or heterophyllous, the leaves glabrous, small, 3-10 mm long, drying flat to half-terete. Flowers in congested, terminal cincinni, more diffusely arranged in one species. Petals yellow, sometimes with short, red, longitudinal stripes, separate, each usually with a thick, raised, medial keel widened at the apex, erect to spreading or reflexed. Stamens 10, those opposite the petals adnate to the petal base; anthers yellow, red in one species. Carpels yellow, erect, the follicles erect to spreading, free or sometimes basally connate, baso-ventrally gibbous, each with numerous seeds. Seeds brown, minutely papillate, echinate in one species. Chromosome numbers, $n=10$ and 26 (known from only 2 species, see below).

KEY TO THE SPECIES OF THE *SEDUM PARVUM* GROUP IN
NORTHEASTERN MEXICO AND TEXAS

1. Stems minutely papillate to papillate-glandular, without a sheen.....(2)
 2. Plants prostrate-decumbent from horizontal rhizomes.....9. *S. dulcinomen*
 2. Plants erect, without stolons or creeping rhizomes.....(3)
 3. Stems 10-25 cm high or long, somewhat glaucous; leaves with prominent, wide, white margins of different texture than the blade; petals often spreading or reflexing.8. *S. catorce*
 3. Plants mostly 4-14 cm high, not glaucous; leaf margins sometimes slightly lighter colored than the blade but then very narrow and not of different texture; petals erect.....(4)
 4. Stems densely and minutely papillate, appearing somewhat stipitate-papillate, the cellular structure not clearly perceptible; leaves flattened or slightly convex above and beneath, the cellular structure evident only in the striate, elongated cells at the abaxial base, the margins sharply flattened and translucent-papillate 11. *S. papillicaulum*
 4. Stems not distinctly columnar- or stipitate-papillate but with quadrate cells clearly perceptible; leaves half-terete, not strongly papillate but both surfaces with clearly perceptible quadrate cells, the margins rounded and not at all papillate.....12. *S. macdonaldii*
1. Stems smooth, not at all papillate or glandular-appearing, with or without a sheen.(5)
 5. Plants prostrate-decumbent from horizontal rhizomes; leaves and petals without prominent red markings.(6)
 6. Stems with a prominent sheen on the lower part, the cells elongate; petals erect, 3-5 mm long.....(7)
 7. Rhizomes completely herbaceous; leaves 4-8 mm long, 2-4 mm wide; flowers in compact, terminal cincinni; petals 4-5 mm long; anthers yellow..... 1. *S. parvum*
 7. Rhizomes thin but noticeably woody; leaves 3.5-5.3 mm long, 1.3-1.8 mm wide; flowers arranged relatively diffusely along upper branches; petals 3.0-3.5 mm long; anthers red.2. *S. diminutum*
 6. Stems without a prominent sheen, the cellular structure not readily apparent, petals spreading, either ca. 2.5 or 6.5-8.5 mm long.....(8)
 8. Petals ca. 2.5 mm long; leaves 2.5-7.0 mm long, 0.8-1.0 mm wide. 4. *S. tamaulipense*
 8. Petals 6-8 mm long; leaves 6.5-8.5 mm long, 2.5-3.5 mm wide. 3. *S. reptans*
 5. Plants erect, without rhizomes; leaves and petals with or without prominent red markings.....(9)
 9. Annual; stems without a sheen; leaves and petals without red markings. 5. *S. nuttallianum*
 9. Perennial; stems with a prominent sheen at least on the lower part; leaves and petals with prominent red markings. (10)
 10. Lower part of stems reddish-shiny; leaves 2.5-3.5 mm long, even in length; petals 4.0-5.1 mm long.6. *S. nanifolium*
 10. Lower part of stems golden-shiny; leaves of lower stems 5-6 mm long, 7-10 mm long near the inflorescence; petals 5.0-7.5 mm long 7. *S. chrysicaulum*

1. *SEDUM PARVUM* Hemsl.

Sedum parvum Hemsl., *Diagn. Pl. Nov. Mex.* 50. 1880. *Altamiranoa parva* (Hemsl.) Rose ex Britt. & Rose, Bull. New York Bot. Gard. 3:32. 1903. *Villadia parva* (Hemsl.) Jacobsen, Natl. Cactus Succ. J. 13:76. 1958. TYPE: MEXICO. San Luis Potosí: In regione San Luis Potosí, 6000-8000 ft, 1878, Parry & Palmer 234 (HOLOTYPE: K; Isotype: GH!).
Sedum pososepalum Frod., Acta Horti Gotob. 10, App.: 66. 1936. TYPE: MEXICO. San Luis Potosí: Alvarez, 13-23 Jul 1904, Palmer 251 (HOLOTYPE: US; Isotype: GH!).

Prostrate-decumbent, completely herbaceous perennials from creeping rhizomes, producing fibrous, adventitious roots. Stems green, smooth, with a noticeable reddish sheen below, the cells elongated. Leaves evenly sized and spaced, green, usually drying translucent, very flat, narrowly elliptic-oblong to narrowly oblanceolate-oblong, 4-8 mm long, 2-4 mm wide. Petals erect, yellow, 4-5 mm long. Seeds echinate.

San Luis Potosí; rock outcrops or ledges in pinyon pine, pine-oak, pine-fir woods; 2000-2700 m; June-October.

In its prostrate habit, shiny stems, and "homophyllous" leaves, *Sedum parvum* is most similar to *S. diminutum*. *Sedum reptans*, which also occurs in San Luis Potosí, can be distinguished by its non-shiny stems, longer petals, and papillate seeds.

2. *SEDUM DIMINUTUM* (R.T. Clausen) Nesom, *comb. et stat. nov.* BASIONYM: *Sedum parvum* Hemsl. subsp. *diminutum* R.T. Clausen, Bull. Torrey Bot. Club 106:215. 1979. TYPE: MEXICO. Coahuila: Cañada La Hacienda, Sierra de la Madera, NW of Cuatro Ciénegas, crevices of limestone in shade of *Quercus*, slope on E side of Cañada, 1860 m, 22 Jul 1978, R.T. Clausen 78-7 (HOLOTYPE: BH!; Isotypes: BH-3 sheets!).

Prostrate-decumbent perennials from slightly woody rhizomes, producing adventitious, fibrous roots. Stems green, smooth, with a noticeably golden sheen below, the cells elongated. Leaves evenly sized and spaced, green, very flat, narrowly elliptic-oblong to narrowly oblanceolate-oblong, 3.7-5.5 mm long, 1.3-1.8 mm wide. Flowers arranged rather diffusely along upper branches, not in congested cincinni. Petals erect, yellow, 3.0-3.5 mm long. Anthers red.

Known only from the type collection. See comments following *Sedum parvum*.

3. *SEDUM REPTANS* R.T. Clausen

Sedum reptans R.T. Clausen, Bull. Torrey Bot. Club 105:222. 1978. TYPE: MEXICO. San Luis Potosí: Sierra de San Luis Potosí, northern slope of Cerro El Ajugon, 21° 40' 45" N, 100° 03' 20" W, 1720 m, 7 Sep 1977, R.T. Clausen 772,036 (HOLOTYPE: BH!).

Sedum reptans R.T. Clausen var. *carinatifolium* R.T. Clausen, *Variation Spec. Sedum* 15, 1981. TYPE: MEXICO. Querétaro: 1 km W of Lazaro Vega, 8 km NE of Vizarron des Montes, 20° 53' 25" N, 99° 39' 40" W, in depressions in limestone exposed to SE, 2250 m, 14 Apr 1980, R.T. Clausen 80-29 (HOLOTYPE: BH!; Isotype: BH!).

Completely herbaceous perennials with prostrate, creeping stems producing fibrous adventitious roots and short, erect or decumbent, leafy stems. Cells of stems quadrate, noticeably papillate in the youngest portions. Leaves terete to subterete to carinate above (fresh), drying [somewhat flattened], 6.5-8.5 mm long, 1.5-2.5 mm wide. Petals spreading, 6-8 mm long. Follicles widely spreading, ventrally gibbous, basally connate for ca. 1/4 their length.

Eastern San Luis Potosí to northeastern Querétaro; limestone rocks; 1700-2250 m; April-September.

In its habit, leaf shape, and morphology of its stems and follicles, *Sedum reptans* is similar to *S. tamaulipense*. Clausen (1981) described subsp. *carinatum* as different from subsp. *reptans* "in the length (8.5 versus 6.7 mm) and length-width ratios (4 versus 2.4 of the leaves" and dorsally carinate leaves. These putative differences (we find overlap in the leaf length) do not appear to us to justify formal nomenclature.

4. *SEDUM TAMAULIPENSE* Nesom

Sedum tamaulipense Nesom, Sida 13:22. 1988. TYPE: MEXICO. Tamaulipas: Mpio. San Carlos, Sierra de San Carlos, ca. 5 mi S of San Carlos, N side of Bufo El Diente, 18 Jun 1987, G. Nesom 6166 (HOLOTYPE: TEX!; Isotypes: BH!, MEXU!, UAT!, WTU!).

Perennial, prostrate herbs with numerous adventitious roots, forming mats, the stems smooth, without a sheen. Leaves narrowly oblong, terete (fresh), drying flattened, 2.5-7.0 mm long, 0.8-1.0 mm wide. Petals ca. 2.5 mm long, yellow, spreading. Follicles spreading, ventrally gibbous, basally connate for 1/2-3/5 their length.

Known only from the Sierra de San Carlos of central Tamaulipas; top of rocks and large boulders with bryophytes, in oak woods with scattered *Carya* and *Abies*; 1100-1250 m; May-August.

5. *SEDUM NUTTALLIANUM* Raf.

Sedum nuttallianum Raf., Atl. J. 1:146. 1832. TYPE: UNITED STATES. [Oklahoma]: drainage of the Red River, Arkansas, 1819, *Nuttall s.n.* (NY). See Clausen (1975) for notes on typification and synonymy.

Erect annual herbs 5-8 cm tall, from a very slender taproot, the stems smooth, without a sheen. Leaves narrowly elliptic-oblong, mostly 3-5 mm long, terete (fresh), drying more or less terete, all more or less similar in size and distribution. Petals yellow, spreading, 2-4 mm long. Follicles widely spreading, ventrally gibbous. Chromosome number, $n=10$ pairs.

Texas, Oklahoma, Arkansas, Missouri; open areas in shallow soil, commonly over granite or sandstone, usually in the area of oak or oak-juniper woods; April-July.

Probably most closely related to *Sedum tamaulipense*, sharing with it distinctively small petals and spreading, ventrally gibbous follicles.

6. *SEDUM NANIFOLIUM* Frod.

Sedum nanifolium Frod., Acta Horti Gotob. 10, App. 196. 1936. *Sedum parvum* Hemsl. subsp. *nanifolium* (Frod.) R.T. Clausen, Bull. Torrey Bot. Club 105:223. 1978. TYPE: MEXICO. Coahuila: Chojo Grande, 27 mi SE of Saltillo, 16 Jul 1905, *Palmer 722* (HOLOTYPE: UC; Isotype: GH!).

Erect perennials to 20 cm high, homophyllous or rarely producing densely leafy shoots. Stems smooth, prominently reddish-shiny on the lower portions, cells elongated. Leaves widely obovate to obovate-oblong, half-terete (flat adaxially), green with prominent red dots, sometimes waxy, 2.5-3.5(-4.0) (-5.0 in Texas) mm long, 2.0-2.5 mm wide, even in length on upper and lower portions of the stem, cells quadrate. Petals erect, 4.0-5.1 mm long, yellow with prominent, short, red, longitudinal stripes. Chromosome number, $n=26$ pairs.

Widespread in eastern Chihuahua, Coahuila, central Nuevo León, and apparently rare in Brewster Co., Texas; limestone gravel, ledges, or crevices, in matorral, chaparral, or pinyon pine woods with juniper, oak, or agave; (1200-)1600-2300 (-2700) m; June-November.

Additional collections examined: MEXICO. Chihuahua: NW end of the Sierra del Diablo, ca. 27° 20' N, 29 Jul 1941, *Stewart 981* (GH). Coahuila: W of El Chorro and ESE of Saltillo, 22 Jun 1978, *Clausen 78,3* (BH-2 sheets); W of Chorro Grande, 25° 23' N, 100° 48' W, 23 Apr 1949, *Clausen 7607* (BH-2 sheets, GH); 17 mi S of Arteaga, 18 Aug 1948, *Kenoyer & Crum 2771* (GH); Del Carmen Mts., 2 Sep 1936, *Marsh 862* (TEX); Sierra de Santa Rosa, NW of Muzquiz, 25 Jul 1938, *Marsh 1476* (GH,TEX); 3 mi N of Puerto Flores, 8 Nov 1957, *Moran 6309* (BH); Sierra de la Encantada, 10 km NW of Rancho Buena Vista, 5 Sep 1941, *Stewart 1428* (GH, TEX); near Lirios, SE of Saltillo, *Strauss s.n.* (BH); Cañon de la Barrica, Sierra de la Madera, 20 Aug 1975, *Wendt 1218* (TEX); Sierra del Carmen, E of Pico de Cerda, 11 Aug 1974, *Wendt 563A* (LL); Sierra del Carmen, 7.9 mi N of Rancho El Jardín on road to Mina El Popo, 22 Sep 1973, *Wendt et al. 63* (LL). Nuevo León: Cañada Zacatosa, 6 km N of La Escondida, 24° 09' N, 99° 55' W, 30 Aug 1977, *Clausen 77,32* (BH-2 sheets); Hwy 51 between Dr. Arroyo and Galeana, 34 km S of jct with Hwy 58 at Puerto de Pastores, 28 Jun 1978, *Cochrane et al. 8459* (BH); 2 mi S of Pabillo, 20 Jul 1958, *Correll & Johnston 19889* (LL); Hwy 68, 17.7 mi S of jct of Hwy 60 and 1.6 mi N of Puerto de Cieneguillos, 24 Sep 1973, *Reveal 3409* (BH); Hacienda Pabillo, Galeana, 8 Aug 1936, *Taylor 103* (TEX)

UNITED STATES. Texas: Brewster Co.: on limestone hills in valley at the S end of Del Nortes, *Hinckley 4114* (BH); Doubtful Canyon, Del Norte Mts., Gage Estate, 25 mi S of Alpine, 18 Sep 1947, *Warnock & Hinckley 7521* (SRSC); Cox

Ranch, 15 mi SE of Alpine, 21 Aug 1960, *Warnock 18644* (SRSC); Doubtful Canyon, Del Norte Mts., 25 Sep 1967, *Warnock 21320* (SRSC).

7. *SEDUM CHRYSICAULUM* J.A. McDonald

Sedum chrysicaulum J.A. McDonald, Sida 14:315. 1991. TYPE: MEXICO. Nuevo León: Mpio. Rayones, summit of Sierra La Marta, ca. 3600 m, 24 Aug 1980, *J. A. McDonald & M. Mayfield 2556* (HOLOTYPE: TEX!).

Erect perennials 5-9 cm high. Stems smooth, prominently golden-shiny on the lower portions, cells elongated. Leaves narrowly oblanceolate-oblong, flat, green with prominent red dots, 2.0-2.5 mm wide, 5-6 mm long on lower stem, 7-10 mm long on the upper portions. Petals erect, 5.0-7.5 mm long, yellow with prominent, short longitudinal, red stripes.

Southeastern Coahuila (Sierra La Viga) and central Nuevo León (Sierra La Marta, Cerro Potosí, Sierra Peña Nevada); grassy subalpine to alpine meadows, often with *Pinus hartwegii* and *P. culminicola*; 3400-3800 m; August-October (November).

Additional collections examined: MEXICO. Coahuila: Mpio. Arteaga, summit of Sierra La Viga, ca. 3600 m, 24 Oct 1984, *McDonald & Gomez 1157* (TEX); Sierra La Viga, 3700 m, 22 Aug 1986, *McDonald 2099* (TEX); Sierra La Marta, 22 Aug 1986, *McDonald 2136* (TEX). Nuevo León: Mpio. Aramberri, Cerro Viejo, 3400 m, 20 Nov 1993, *Hinton et al. 23971* (TEX); Mpio. Doctor Arroyo, Sierra de Peña Nevada, N of Picacho de San Onofre, ca. 3400 m, 30 Nov 1984, *McDonald & Gomez 1298* (TEX); Mpio. Galeana, summit or near summit of Sierra La Marta, 3600 m, 31 Aug 1980, *Hinton et al. 17977* (TEX), Sierra La Marta, 3680 m, 4 Aug 1980, *Hinton et al. 17919* (TEX); 25 Oct 1984, *McDonald & Gomez 1242* (TEX); 22 Aug 1986, *McDonald 2136* (TEX); summit or near summit of Cerro Potosí, 23 Aug 1984, *Lavin 4787* (TEX); Cerro El Potosí, 3810 m, 14 Oct 1970, *Hinton et al. 17303* (TEX).

This is the most widespread of the high-elevation *Sedum* species of northeastern México. It is most closely related to *S. nanifolium*, with which it shares an erect habit, shiny stems with elongated cells, and the distinctive red markings in the leaves and petals.

8. *SEDUM CATORCE* Nesom, *nom. et stat. nov.*

Sedum parvum Hemsl. subsp. *dendroides* R.T. Clausen, Bull. Torrey Bot. Club 105:223. 1978. TYPE: MEXICO. San Luis Potosí: 0.5 km W of Real de Catorce, 23° 41' 24" N, 100° 53' 32" W, cliff of quartzite exposed to southwest, N side of canyon, 2620 m, 23 Aug 1977, *R.T. Clausen 772.028*--pressed from greenhouse-grown plants (HOLOTYPE: BH!; Isotype: BH!). Non *Sedum dendroideum* DC.

Erect to semi-erect, slightly glaucous perennials 10-25 cm high, roots said to be tuberous. Stems strongly woody, sometimes somewhat pendant from cliff sides, reddish, minutely papillate, not at all shiny, cells quadrate. Leaves homophyllous, lanceolate-oblong, flat but from a swollen base, (3.0-)3.5-5.0 mm long, 1.3-2.0 mm

wide, dark green with prominent white margins, venation usually clearly discernible. Petals erect to spreading or reflexed; 6-7 mm long, yellow.

Known only from cited collections.

9. ***SEDUM DULCINOMEN*** Nesom, *spec. nov.* TYPE: MEXICO. Nuevo León: [Mpio. Zaragoza], 2 mi E of Dulces Nombres, succulent on limestone outcrops, 1850 m, 28 Jun 1948, *F.G. Meyer & D.J. Rogers 2699* (HOLOTYPE: BH!).

Sedo catorce Nesom, *S. papillicaulo* Nesom, et *S. macdonaldii* Nesom caulibus papillatis similis sed distinctus habitu prostrati-decumbenti caulibus ex rhizomatibus horizontalibus radicibus adventitiis orientibus; *Sedo catorce* similis caulibus ac foliis glaucis.

Prostrate-decumbent perennials from horizontal, slightly woody rhizomes, producing fibrous, adventitious roots, stems and leaves heavily glaucous (less so in cultivation). Stems green, becoming reddish-tinted, but without discrete dots of red pigment, minutely papillate with quadrate cells, arching upward or erect and arising from the rhizomes. Leaves heterophyllous, green, heavily glaucous (less so in cultivation), flat, elliptic-oblong, 1.5-2.0 mm wide, 2.5-4.5 mm long. Petals erect, yellow, 4.5-6.0 mm long.

Nuevo León, on the Tamaulipas border near Dulces Nombres; limestone ledges and outcrops in pine woods; 1750-2000 m; February-June.

Additional collections examined: MEXICO. Nuevo León: Mpio. Zaragoza: ca. 16 km E of mine in District of Dulces Nombres, Feb 1950, *J.L. Edwards s.n.*--pressed from greenhouse cultivar (BH); ca. 3 km SE of Santa Teresa, "39" Jan 1980. *Clausen U2724*--pressed from greenhouse cultivar (BH).

The three collections studied of *Sedum dulcinomen* are very similar among themselves. The specimen collected from nature (the type), is strongly glaucous, but the greenhouse-grown plants show clear traces of a waxy surface. Among the other species treated in this study, only *S. catorce* produces a glaucous covering.

10. ***SEDUM PAPILLICAULUM*** Nesom, *spec. nov.* TYPE: MEXICO. Nuevo León: Mpio. Zaragoza, Sierra de Peña Nevada, Picacho San Onofre, fir and pine forest, 3000 m, 18 Jun 1979, *Hinton et al. 17551* (HOLOTYPE: TEX!).

Sedo catorce Nesom et *S. macdonaldii* Nesom habitu erecto et caulibus papillatis similis sed distinctus paginis non glaucis, foliis planis, et papillis caulinis columnaribus structuram cellulosa perspicua carentibus.

Erect, fibrous-rooted perennials 6-25 cm high. Stems suffruticose, prominently minutely and densely papillate, the papillae columnar and sometimes appearing stipitate-glandular, the cellular structure not readily apparent. Leaves oblong-elliptic to lanceolate-oblong, flat, 3-4 mm long, even in length on the upper and lower portions

of the stems, 1.5-2.2 mm wide, the cells quadrate in the distal portions, elongate in the swollen basal portion. Petals erect, yellow, rarely with a reddish tinge, 5-7 mm long.

Nuevo León; subalpine and alpine meadows of Sierra Peña Nevada and vicinity, usually with *Pinus hartwegii* or pine-fir, sometimes in oak-agave woodland; (2700-) 3000-3600 m; June-August.

Additional collections examined: MEXICO. Nuevo León: Mpio. Doctor Arroyo: ridge and E side of Peña Nevada, 5 Jul 1985, *McDonald 1642* (TEX); trail from Cañon La Tinaja to La Encantada, 4 Jul 1988, *Patterson 5837* (TEX); N and NW slope of Picacho Onofre, 10-15 Jul 1977, *Wells & Nesom 369* (TEX). Mpio. Zaragoza: Cerro El Viego, 1800 m, 7 Jul 1992, *Hinton et al. 22125* (TEX); Cerro El Viego, 3360 m, 6 Oct 1992, *Hinton et al. 22147* (TEX); 9 km N of La Encantada, 2700 m, 25 May 1992, *Hernández et al. 2284* (TEX); 2 m NE Cerro Peña Nevada, 2690 m, 23 Aug 1989, *Nesom 7121* (TEX). Tamaulipas: 15 km NW Estanque de los Walle, 2000 m, 25 Oct 1989, *Hernández S. 2063* (TEX).

A distinctive species restricted to the Peña Nevada area of southeastern Nuevo León but closely similar to *Sedum macdonaldii*, which appears to be its northern vicariad.

11. **SEDUM MACDONALDII** Nesom *spec. nov.* TYPE: MEXICO. Nuevo León: Mpio. Galeana, Sierra La Marta, S and SE sides at the top, alpine and subalpine zone, 22 Aug 1986, *Andrew McDonald 2135* (HOLOTYPE: TEX!); Isotypes: MEXU, BH).

Sedo catorce Nesom et *S. papillicaulo* Nesom habitu erecto et caulibus papillatis similis sed distinctus paginis non glaucis, foliis semi teretibus et cellulisquadratis in lineis papillas caulinas formantibus.

Erect fibrous-rooted perennials 4-7 cm high. Stems mostly obscured by the leaves but the surfaces low-papillate with quadrate cells in lines. Leaves half-terete, flat above with a medial sulcus, both surfaces with quadrate cells from tip to base, minutely striate-papillate, the cellular structure clearly perceptible. Petals yellow, erect, 6-7 mm long.

Coahuila (Sierra Coahuilón, Sierra La Viga), Nuevo León (Cerro Potosí and Sierra La Marta); subalpine and alpine zones, often with *Pinus hartwegii*, *Pinus culminicola*, or *Pseudotsuga*; 2850-3600 m; July-October.

Additional collections examined: MEXICO. Coahuila: Mpio. Arteaga, ridge and SE side of Sierra Coahuilón, 22 Jul 1985, *McDonald 1762* (TEX); summit of Sierra La Viga, 24 Oct 1984, *McDonald & Gomez 1158* (TEX). Nuevo León: Mpio. Galeana: Sierra La Marta, near top, 5 Jul 1981, *Hinton et al. 18310* (TEX); SE side of Cerro Potosí, 25 Jun 1960, *Beaman 3321* (GH); near top of Cerro Potosí, 3500 m, 23 May 1988, *Westlund 23* (TEX).

Sedum macdonaldii apparently is most closely related to *S. papillicaulum*, which differs in its flat (dried) leaves with a basal area of elongated cells and its strongly stipitate-papillate stems, the cellular structure of which is not at all discernible.

INCERTAE SEDIS

Sedum robertsonianum E.J. Alexander, Bull. Torrey Bot. Club 63:201. 1936. *Sedum parvum* Hemsl. subsp. *robertsonianum* (E.J. Alexander) R.T. Clausen, *Variation Spec. Sedum* 16. 1981. TYPE: UNITED STATES. Texas: Brewster Co., mountain top in shallow calcareous soil, 4000 ft, A.R. Davis s.n. (HOLOTYPE: NY, from cultivar of Davis collection.)

Clausen (1981) could not find the type at NY and made the following comment: "Because no type is at the New York Botanical Garden, a part of the type material, made available by Mr. Alexander and cultivated and pressed at Cornell University on July 22, 1937, may serve as the lectotype. The specimen is in the herbarium at Cornell University."

[It] "combines features of the other subspecies: longer leaves (8.6 mm) as in ssp. *diminutum*, wider leaves (3.7 mm) as in ssp. *nanifolium*, longer anthers (1.1 mm) as in ssp. *dendroides*, narrower nectaries (0.4 mm) as in ssp. *diminutum*, and later flowering (Aug.-Sept.) as in ssp. *parvum*. It is the most herbaceous of the five subspecies. Otherwise, it is similar to the other subspecies in having cymes of 1-2 cincinni, yellow flowers, gibbous follicles, and fuscous, papillose seeds." Clausen (ms), in his forthcoming treatment of *Sedum* for the Flora of the Chihuahuan Desert (Henrickson, in prep.), places *S. robertsonianum* in synonymy under *S. parvum* Hemsl.

Erect, fibrous-rooted perennials. Stems [papillate?], both stems and leaves "red-streaked and spotted." Heterophyllous, the leaves 5-8 mm long, 3-4 mm wide, subterete (fresh), papillate, the cells quadrate. Petals yellow, 4 mm long, spreading-reflexed. Carpels erect, the follicles spreading, baso-ventrally gibbous.

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